CECW-ETE

DEPARTMENT OF THE ARMY
U.S. Army Corps of Engineers
Washington, D.C. 20314-1000

ETL 1110-3-491

Technical Letter
No. 1110-3-491

1 May 2001

EXPIRES 31 MARCH 2005

Engineering and Design

SUSTAINABLE DESIGN FOR MILITARY FACILITIES

1. Purpose. This letter provides basic criteria and information pertaining to the incorporation of sustainable design concepts in the design and construction of Military facilities.

2. Applicability. This letter applies to all HQUSACE elements and USACE commands having Army military construction and design responsibility.

3. Distribution. Approval for public release; distribution is unlimited

4. References. See Appendix A.

5. Objective. Sustainable Design is the design, construction, operation, and reuse/removal of the built environment (infrastructure and buildings) in an environmentally and energy efficient manner. The major tenet of sustainable design is to meet the needs of the present without compromising the ability of future generations to meet their own needs. Synonymous with Sustainable Design is "Green Building." Sustainable design includes efficient use of natural resources, better performing, more desirable, and more affordable infrastructure and buildings. Sustainable design incorporates the energy efficiency concerns of the 1970's with the concerns in the 1990's related to damage to the natural environment; emissions of greenhouse gases and ozone depleting chemicals; use of limited material resources; management of water as a limited resource; reductions in construction, demolition and operational waste; indoor environmental quality; and occupant/worker health, productivity and satisfaction. This ETL provides designers with guidance on sustainable design for the design and construction of all new Army facilities, and the rehabilitation/renovation of existing facilities.

6. Action. The guidance in Appendix B to this technical letter will be used for planning, design and construction of Army facilities to incorporate Sustainable Design or Green Building concepts. Effective immediately all of our deign for military facilities shall phase in SDD and shall strive to achieve SPiRiT Bronze level AS DEFINED IN Appendix C.

This engineer technical letter supersedes ETL 110-3-491 dated 31 Jan 2000

7. Imnlementation. This technical letter will have immediate application, as defined in paragraph 6c, ER 1110-345-100.

FOR THE COMMANDER:

For

DWIGHT A. BERANEK, P.E.
Chief, Engineering and Construction Division
Directorate of Civil Works

3 Appendices
APP A - References and Bibliography
APP B - Sustainable Design for Military Facilities
APP C - Sustainable Project Rating Tool (SPiRiT)

APPENDIX A

REFERENCES AND BIBLIOGRAPHY

1. Referenced Laws, Regulations And Publications

a. Alternative Motor Fuels Act (AMFA) of 1988, P.L. 100-494 (42 USC 6374).

b. Energy Policy Act (EPACT), P.L. 102-486, December 1992.

c. National Environmental Policy Act (NEPA) of 1969; as amended by P.L. 91-190, 42 U.S.C. 4321-4347, January 1, 1970; P.L. 94-52, July 3, 1975; P.L. 94-83, August 9, 1975, and P.L. 97-258, 4(b), Sept. 13, 1982.

d. National Pollution Discharge Elimination System (NPDES), established by Clean Water Act, 33 U.S.C. Chapter 26, established 1972 and as amended.

e. Executive Order 12873, Federal Acquisition, Recycling, and Waste Prevention, signed on August 6, 1993.

f. Executive Order 12902, Energy Efficiency and Water Conservation at Federal Facilities, signed on March 8, 1994.

g. Executive Order 13123, Greening the Government Through Efficient Energy Management, signed on June 3, 1999.

h. Executive Memorandum, Environmentally and Economically Beneficial Practices on Federal Landscape Grounds, signed on April 26, 1994.

i. Technical Manual 5-803-13, Landscape Design and Planting

j. Technical Manual 5-803-14, Site Planning and Design

k. MIL-HDBK 1165, Military Handbook, Water Conservation.

l. Engineering Regulation (ER) 1110-345-100, Design Policy for Military Construction.

m. Comprehensive Procurement Guidelines I (CPG I) for Products Containing Recovered Materials; Final Rule [60 FR 21370, May 1, 1995].

n. Comprehensive Procurement Guidelines II (CPG II) for Products Containing Recovered Materials; Final Rule [62 FR 6096, November 13, 1997].

o. Recovered Materials Advisory Notice I (RMAN I); Final Notice of Availability, [60 FR 21386, May 1, 1995].

p. Recovered Materials Advisory Notice II (RMAN II); Final Notice of Availability, [62 FR 60995, Nov 13, 1997].

q. American Society of Heating, Refrigerating and Air-Conditioning Engineers ASHRAE) Standard 62-1989, Ventilation for Acceptable Indoor Air Quality.

r. Federal Recycling Guide for Waste Prevention, Recycling and Buying Recycled, EPA-904B95007, USEPA Region 4 Library, 345 Courtland Street, N.E., Atlanta, GA.

s. Illumination Engineering Society of North America (IESNA), 120 Wall Street, New York, NY.

t. Leadership in Energy and Environmental Design (LEED) Building Rating System, U.S. Green Building Council, 90 Montgomery St., Suite 1001, San Francisco, CA.

2. Bibliography

a. Recommendations for Incorporating Green Building Concepts in USACE Guidance Documents, Prepared by the Civil Engineering Research Foundation (CERF) for Headquarters, U.S. Army Corps of Engineers, Washington, DC, 1995.

b. Sustainable Building Technical Manual--Green Building Design, Construction, and Operations. Prepared by Public Technology, Inc., for the U.S. Green Building Council. Sponsored by U.S. Department of Energy and U.S. Environmental Protection Agency, 1996.

c. U.S. Air Force Environmentally Responsible Facilities Guide (Draft), Prepared by Hellmuth, Obata & Kassabaum (HOK), Inc., for the U.S. Air Force Center for Environmental Excellence, Brooks AFB, San Antonio, TX, 1996.

d. Sustainable America: A New Consensus for Prosperity, Opportunity, and a Healthy Environment for the Future, 1996, The President s Council on Sustainable Development (PCSD). US Government Printing Office, Superintendent of Documents, Washington, DC 20402-9328.

e. Sustainable Communities: A New Design Synthesis for Cities, Suburbs and Towns, 1986, Sierra Club Books, PO Box 7959, San Francisco, CA, 94120-7959.

f. A Sustainable World: Defining and Measuring Sustainable Development, 1994, International Center for the Environment and Public Policy, P.O. Box 189040, Sacramento, CA 95818.

g. Community Energy Workbook: A Guide to Building a Sustainable Economy, 1995, Rocky Mountain Institute, 1739 Snowmass Creek Road, Snowmass, CO, 81654.

APPENDIX B

SUSTAINABLE DESIGN FOR MILITARY FACILITIES

APPENDIX B
SUSTAINABLE DESIGN FOR MILITARY FACILITIES

1. Background

a. On June 3, 1999 Executive Order (E.O.) 13123, "Greening the Government Through Efficient Energy Management" was signed. This E.O. establishes goals for greenhouse Gases (GHG) reduction, energy efficiency improvement, industrial and laboratory facilities, renewable energy, petroleum, source energy, and water conservation. E.O. 13123, Part 2 – GOALS, lists seven goals for facilities. Six of the seven specifically emphasize that "life-cycle cost-effective" means are to be used to comply with these goals. The E.O. specifically states that: "agencies shall apply such principles to the siting, design, and construction of new facilities. Agencies shall optimize life-cycle costs, pollution, and other environmental and energy costs associated with the construction, life-cycle operation, and decommissioning of the facility." This emphasis on life-cycle cost effectiveness may, in many occasions, make it more difficult to achieve goals established by this E.O.. E.O.'s 12902, 12845 and 12795 are revoked by E.O. 13123.

b. On August 6, 1993 Executive Order (EO) 12873, "Federal Acquisition, Recycling, and Waste Prevention," was signed. Section 401 of this E.O. states that "In developing plans, drawings, work statements, specifications, or other product descriptions, agencies shall consider the following factors: elimination of virgin material requirements; use of recovered materials; reuse of product; life cycle cost; recyclability; use of environmentally preferable products; waste prevention (including toxicity reduction or elimination); and ultimate disposal, as appropriate." The EO also directed the Environmental Protection Agency (EPA) develop guidance to help federal agencies incorporate environmental preferability into their purchasing procedures.

c. In response to EO 12873, EPA developed Comprehensive Procurement Guidelines (CPG I and II). These are the first formal regulations implementing sustainability requirements. The companion Recovered Materials Advisory Notices (RMAN I and II) contain EPA's recommendations for purchasing all items designated in the final CPGs. Currently, EPA has designated 36 items that are, or can be, manufactured using recycled and recovered materials. Construction, landscape, park and recreation products are among the designated items. Federal Agencies are required to purchase EPA-designated items meeting minimum recycled-content standards unless they are not available within a reasonable period of time; fail to meet reasonable specification standards; are not available from two or more sources (to maintain competition); or are unreasonably priced (5% higher than comparable non-recycled products). Recycled-content purchase requirements are discussed in EPA's "Federal Recycling Guide for Waste Prevention, Recycling and Buying Recycled."

2. Definition

a. Sustainable Design (Green Building) is the design, construction, operation, and reuse/removal of the built environment (infrastructure as well as buildings) in an environmentally and energy efficient manner. Sustainable Design is meeting the needs of today without compromising the ability of future generations to meet their needs. Sustainable Design includes not only efficient use of natural resources, but it can also translate into better performance, desirability, and affordability.

b. Sustainable Design incorporates the energy concerns of the 1970's with new concerns in the 1990's, including damage to the natural environment; emissions of greenhouse gases and ozone depleting chemicals; use of limited material resources; management of water as a limited resource; reductions in waste; indoor environmental quality; and occupant/worker health, productivity and satisfaction. Ideally, we would only use resources in the built environment at the speed at which they naturally regenerate, and discard them at or below the rate at which they could be absorbed by natural ecological systems.

c. While the ideal may not be achievable at present, those involved in designing, constructing, operating, maintaining, and retiring the components of the built environment, such as the U.S. Army Corps of Engineers (USACE), can take steps now to maximize energy efficiency and minimize environmental impact. Green Building goes beyond simple green products and recycled materials. Green Building is an environmental consciousness or resource awareness about using or not using our valuable natural resources in an energy-conscious or conservative way. This is an important concept. It is an attitude about applying sound design principles and practices to create a built environment, which optimizes the functionality and operability of the total system while incorporating sustainable design principals.

3. Goals and Objectives of Sustainable Design

a. The overall USACE goal of Sustainable Design is to be environmentally responsible in the delivery of facilities. The key traditional elements for decision making in the facility delivery process are cost, quality and time. These elements need to be expanded to include the ecological and human health impacts of all decisions.

b. Each project generates its own set of goals. However, sustainable design goals should apply to all projects. The goals for improving the environmental performance of facilities include: (a) use resources efficiently and minimize raw material resource consumption, including energy, water, land and materials, both during the construction process and throughout the life of the facility, (b) maximize resource reuse, while maintaining financial stewardship, (c) move away from fossil fuels towards renewable energy sources, (d) create a healthy and productive work environment for all who use the facility, (e) build facilities of long-term value, and (f) protect and, where appropriate, restore the natural environment.

c. Identify environmental goals and requirements from paragraph 3A and 3B above to be implemented during the design process, and include them in the project development document. Integrate into the project planning and goal setting process applicable requirements from the installation Pollution Prevention (P2) Program. Make decisions during the planning and design process to support installation-wide reduction in the release of ozone depleting chemicals (ODC) and greenhouse gases; reduction in the use of hazardous materials and pesticides, and the generation of solid wastes; and support the EPA 33/50 Program (a voluntary program targeting 17 chemicals for reduction).

d. Where possible, budget for environmental and energy-efficient equipment, systems, and design solutions based on life cycle cost assessment (LCCA). Consider potential for cost-effective use of photovoltaics, on-site wastewater treatment, and graywater systems. Generally the potential for these is greatest in remote areas. Where those technologies show promise, include as special requirements in the project description, and budget accordingly.

e. While developing the DD1391, identify funding sources for sustainable features that cannot be addressed within the Programmed Amount (PA). Also identify, by line item, resources required for desired level of Systems Commissioning and for the preparation of O&M Manuals.

4. Project Design Team

a. Only through an interdisciplinary approach can true sustainability be achieved. Technical Manual 5-803-14, Site Planning and Design, describes the design team. Guidelines set forth in the AEI on Installation Support should be followed in establishing the design team. The makeup of the team will be determined by the particular type of project, but members must achieve a common understanding of environmental and energy conservation concerns. All members of the design team should participate in initial goal setting and should also attend the design charette.

b. Set clear and specific environmental and energy conservation goals for the project. Quantify goals wherever possible; for example, energy use, water use, allowable levels of volatile organic compounds (VOC) emissions, etc. The Environmental members of the design team shall educate the entire team about opportunities for incorporating sustainable design.

c. Consideration of many more system options will require extensive training, criteria, policy, additional computer modeling software, and additional experience to enable the selection of the most Life-Cycle Cost Effective solutions. Building Commissioning will be necessary to initiate proper operation of these more complex systems. Facilities will require the installation, periodic calibration, maintenance, and repair of additional meters.

5. Planning and Site Selection

a. Use the procedures described in Technical Manual 5-803-14, Site Planning and Design, to analyze the site. In addition, when planning and selecting a site, the following should be considered to minimize environmental impacts: (a) renovate and reuse existing buildings, where possible, (b) leave pristine areas untouched and minimize disturbance to wildlife habitats, (c) give priority to and build on previously disturbed or damaged sites, and, where possible, restore damaged areas, (d) minimize transportation requirements for the transport of goods and services and for employee, occupant, or customer commuting, (e) maximize existing transportation links, especially public transit, and minimize the need to build new links, and (f) maximize cluster development strategies to reduce disturbance of open areas and reduce utility and transportation costs.

b. Review the established Installation Master Plan, Installation Design Guide, general planning guidelines, or sub-installation area development plans to ensure an optimal coordinated site selection, as described in Technical Manual 5-803-14. Rank alternate sites for the proposed project based upon a comparative analysis of the issues. Consider the potential environmental impacts the proposed improvements will have on the surrounding environment, neighboring communities and cultural resources. Review the Environmental Impact Statement (EIS), and pay particular attention to impacts of decreased water quality, increased storm water runoff, increased erosion potential and ambient air quality. Ensure compliance with the National Environmental Policy Act (NEPA). Consider the reuse or rehabilitation of an existing previously developed site rather than altering undisturbed raw land, if an existing base is not to be utilized for the proposed improvements. Consider the location of the proposed site in relation to existing facilities to minimize transportation requirements and to provide opportunities for shared use of common areas wherever possible. Understand the micro-climate of each site and identify which sites have the best potential for sustainable design based on temperature, humidity, wind and solar orientation. Consider each site's potential for producing alternative forms of electricity. For example, remote guard shacks may be good candidates for the use of photovoltaics. Consider the vegetation and topography of each site and identify which site would require the least amount of disruption in order to accommodate the proposed improvements. Consider the geology and hydrology of each site and identify which sites are most suitable for the proposed improvements. Avoid development of sites that would adversely affect watersheds. Consider any potential for cleanup (Installation Restoration Program) requirements for the site. Understand the ecology of the site in order to identify natural habitats that may be endangered through its development, and select a site on which the proposed improvements can be developed in a manner that maintains the existing ecological balance.

6. Site Development

a. The project site should be developed as described in Technical Manual 5-803-14 and within the following guidelines to ensure minimum environmental disturbance: (a) protect site natural resources, such as water, soil, vegetation, natural amenities, etc., (b) place infrastructure and buildings on the site (cluster buildings, where possible) to minimize disturbance, preserve open space and environmentally sensitive areas, and to make beneficial use of renewable resources (sun, wind, rain, snow, etc.)., and (c) maximize the use of existing site conditions such as: natural drainage patterns, natural vegetation and soils, clean air, etc.

b. A complete site survey and soils report should be produced as described in Technical Manual 5-803-14. Include watersheds, drainage areas, stream corridors, wetlands, aquifer recharge zones, hundred year flood plains, special vegetative areas, and a tree survey (include location, genus and species) of all trees sized 15 cm DBH (diameter breast height) or greater. Identify locations of any special cultural or archaeological sites. Document all information on site analysis drawings. Test site radon levels if the region has potential for radon contamination. Develop a plant list to be used during the design process that identifies acceptable native plants and other plants that are suitable for use on the site based upon existing climate, soils and ecology and pest and disease considerations, as described in Technical Manual 5-803-13, Landscape Design and Planting.

7. Sustainable Design and Construction of the Built Environment

Design and construction of sustainable buildings should be in accordance with the following concepts:

a. Strategic Facility Planning and Programming--Analysis to determine whether to renovate or build new, sell existing facilities or lease, consolidate or decentralize, is critical to ensuring long-term viability, resource conservation and life-cycle cost benefits;

b. Site Work and Planning--Environmentally sensitive planning looks beyond the boundary of the project site to evaluate linkages to transportation and infrastructure, ecosystems and wildlife habitat and community identification. Site planning evaluates solar and wind orientation, local microclimate, drainage patterns, utilities and existing site features to develop optimal siting and appropriate low maintenance landscape plant material;

c. Building Layout and Design--Optimize building size, and maintain an appropriate building scale for the environment and context of the building or a building component. Layout the rooms of a building for energy performance and comfort, and design for standard sizes to minimize material waste. Pay careful attention to the location of exterior windows. Avoid structural over-design and the resultant waste. Design components of the built environment for durability and ease of adaptation to other uses, and for waste recycling.

d. Energy--Building orientation and massing, natural ventilation, day-lighting, shading and other passive strategies, can all lower a building's energy demand and increase the quality of the interior environment and the comfort and productivity of occupants. The efficiency of required systems is maximized through use of advanced computer modeling and life cycle cost analysis;

e. Building Materials--Environmentally preferable building materials are durable and low maintenance. Within the parameters of performance, cost, aesthetics and availability, careful selection and specification can limit impacts on the environment and occupant health;

f. Indoor Air Quality--Indoor air quality is most effectively controlled through close coordination of architecture, interiors and MEP design strategies that limit sources of contamination before they enter the building. Construction procedures for IAQ and post-occupancy user guides also contribute to good long-term IAQ;

g. Water--Site design strategies that maximize natural filtration of rainwater and consideration of on-site biological treatment systems for building gray water and waste water can enhance water quality. Water conservation is enhanced by low flow plumbing fixtures, water appropriate landscaping and HVAC and plumbing system design;

h. Recycling and Waste Management--Waste and inefficiency can be limited during construction by sorting and recycling demolition and construction waste, reuse of on-site materials and monitoring of material use and packaging. Accommodating recycling into building design reduces waste while generating revenues;

i. Building Commissioning, Operations and Management--Effective building commissioning is essential to ensure proper and efficient functioning of systems. Facilities operations benefit from the monitoring of indoor air quality and energy and water saving practices, waste reduction and environmentally sensitive maintenance and procurement policies; and

j. Strategic Environmental Management--By integrating long-range environmental considerations into their proactive planning process, manufacturing-based organizations (such as AMC) can eliminate emitted or discharged pollutants. Strategic environmental management helps to understand and assess environmental risks and opportunities so users can make informed decisions about their facilities and processes.

k. Construction Contracts—Administration of construction contracts with new incentive clauses and complex shop drawings will require additional training, experience, resources and acquisition strategies.

8. Maximizing User Health and Productivity

a. In order to maximize the health and productivity of inhabitants and users of sustainable projects, the following guidelines should be followed to the maximum extent practicable:

(1.) Pay particular attention to indoor air quality, i.e., minimize radon entry, exposure to electromagnetic fields, pesticides, products that release formaldehyde and volatile organic compounds, and other "sick building" factors, and

(2.) Provide adequate, efficient lighting, and where possible, incorporate into design of a building: day lighting, natural ventilation, views, greenery and other indoor environmental amenities.

(3.) Provide effective air distribution patterns and ensure that temperature and humidity comply with existing Corps criteria.

b. Use existing Corps criteria as well as ASHRAE Standard 62-1989, Ventilation for Acceptable Indoor Air Quality, as a design guideline. Document IAQ related site characteristics. In urban, industrial or other areas with possible air quality problems, test ambient air quality on-site. Typical facility-related air pollutant emissions sources to be addressed include aircraft operations, motor vehicles, energy generators and boilers, incinerators, industrial processes (such as plating, spray-painting and abrasive blasting), volatile fuels and solvents, jet and rocket engine test facilities, asphalt/concrete plants, wastewater treatment facilities and bakeries and laundries. Determine air filtration requirements and ensure that the requirements of CEGS 15895, Air Supply and Distribution System, are met. Consider air filter alarms to notify building maintenance personnel so that excessive static pressure does not develop and compromise efficiency. Determine fresh air rates based on ASHRAE Standard 62-1989 and other Corps criteria. Do not underestimate occupant densities. Consider programmed number of occupants plus visitors and plan for possible future requirements.

9. Designing for Energy Efficient Operation

a. Sustainable design requires the use of energy efficient equipment and systems, such as the following:

(1.) Use high levels of insulation, tight construction, high-performance windows (superior insulating value), and glazing with low solar heat gain (in appropriate climates).

(2.) Make use of renewable energy sources, i.e., passive solar heating, natural cooling or ventilation, day-lighting, photovoltaic electricity production, etc, where life cycle cost effective.

(3.) Use energy conserving mechanical and electrical equipment and their accessories, as well as lighting, that meets or exceeds existing Corps criteria. Investigate the use of cleaner fuels such as natural gas and cogeneration where remote government owned power plants are available.

b. Ensure that the design methodology and other energy conservation criteria of Chapter 11, Architectural and Engineering Instructions--Design Criteria, are followed or exceeded, including the selection of equipment and systems based on life cycle cost and compliance with energy use budgets. Consider the use of low energy consuming systems such as geothermal heat pumps, desiccant cooling and thermal storage, as well as equipment that exceeds the minimum energy efficiencies contained in the CEGS and other Corps criteria.

c. Gather information on the climate including temperature, humidity, insulation, wind, precipitation and other weather anomalies. Identify aspects of the micro-climate that create opportunities for energy conservation such as solar orientation for passive and/or active solar strategies, and topography or vegetation for shade and windbreaks. Explore energy sources available at the site. Identify opportunities for the cost-effective use of alternative energy resources such as photovoltaic panels, wind, biofuels and geothermal. Review utility rate structures and identify demand charges. Evaluate potential for utility rebates. Investigate building usage patterns and occupant loading rates for optimum conditions.

d. Determine lighting levels for all programmed areas based on Illumination Engineering Society (IES) recommendations. Consider lighting strategy when determining foot-candle levels (e.g., uplighting, downlighting, etc.). When task lighting is anticipated, reduce ambient lighting levels accordingly. Determine plug loads for energy modeling purposes based on the probable usage. Consider difference between energy surge during equipment start up and actual energy usage of equipment, and factor in diversity to reflect actual number of equipment users at any given time. Plug loads are commonly overestimated. Require office equipment and appliances to meet the requirements of the EPA Energy Star program.

10. Management of Water as A Limited Resource

a. Water is one of our most important life sustaining resources; with potable water being critical in much of the U.S. Sustainable Design requires careful consideration of the following: (a) utilize xeriscape design principles, and water-efficient, low-maintenance, native landscape materials, (b) utilize water-efficient plumbing fixtures, (c) design for the reuse of rainwater and "graywater" (water from showers, sinks, and washing machines) where permitted, and (d) recycle sewage treatment plant sludge or minimize the environmental impact of its disposal.

b. The designer must evaluate the possibility of eliminating permanent irrigation systems through the use of plant materials that are appropriate for the site's climate and soils as described in TM 5-803-13. If plant materials with supplemental water requirements are desired, limit their use to a defined area and utilize efficient drip irrigation systems. The designer should evaluate potential for rainwater retention or graywater recycling as described in TM 5-803-14. Analysis using LCCA is required if systems were identified during the planning phase. Ideal applications are regions with limited water availability and where some landscape irrigation is desirable.

c. Since graywater reclamation and wastewater treatment facilities require regulatory authority approval, initiate the permitting process as soon as the requirement is known. Identify the personnel who will operate and maintain the treatment system and obtain their input before selecting a system. Evaluate potential for cost-effective mechanical or biological on-site wastewater treatment of wastewater or runoff from paved areas. Analysis using LCCA is required if these systems were identified during the Planning Phase. Ideal applications for wastewater include facilities with high water use requirements and localities where water treatment is limited and/or costly. Ensure that facility siting is in accordance with the wellhead protection plan of the installation. Develop water-conserving criteria for plumbing fixtures.

d. At a minimum, the designer must use low-flow fixtures as described in CEGS 15400, Plumbing, General Purpose, and CEGS 15405, Plumbing, Hospital. Evaluate requirements for National Pollution Discharge Elimination System (NPDES) permitting, resulting from facility operations or construction. Facilities and surrounding area should minimize potential for storm water runoff and resulting erosion.

11. Resource-Efficient Materials In Design and Construction

a. The designer must incorporate Sustainable Design by investigating the following:

(1.) Consider the total life-cycle costs and environmental impact of products and materials rather than just their initial price. Use durable products and materials. Select materials with low embodied energy.

(2.) Avoid environmentally harmful materials, i.e., those containing ozone-depleting chemicals or releasing gaseous pollutants, toxins, etc. Also avoid utilizing excessive packaging, where possible.

(3.) Buy locally produced materials to minimize the impact of transporting them.

(4.) Reuse salvaged materials, or use products made from recycled materials. Select materials that can be recycled at the end of their use.

(5.) Use integrated pest management practices to reduce the use of pesticides that may present a hazard to humans and the environment. In selecting pest management, preference should be given to practices that minimize or eliminate the need for chemical applications.

b. Designers will specify a preference for recycled-content building materials in accordance with EPA Guidelines. Designers should identify locally manufactured building materials and products, and create list of manufacturers/suppliers for the design team. This process will streamline materials research during design, and will enhance early consideration of locally manufactured types of products. This process will not be used to limit competition during bidding. As an exception, the designer of historic building renovations will identify building materials for renovation, etc. These materials are subject to the Secretary of Interior Standards.

12. Green Building Rating System: Sustainable Project Rating Tool (SPiRiT)

a. SPiRiT is a USACE developed rating tool that resulted from the Army Chief of Staff for Installation Management (ACSIM) memo, 1 May 2000 decreeing that all future facilities be designed and built according to sustainable principles as well as requesting USACE to provide technical guidance to support this initiative. USACE has a licensed agreement with the US Green Building Council permitting us to use its name Leadership in Energy and Environmental Design (LEED) as part of SPiRiT. The LEED Green Building Rating System is a proprietary program of the US Green Building Council. With the use of SPiRiT we will ensure that Sustainable Design and Development is considered in Army installation planning decisions and infrastructure projects to the fullest extent possible, balanced with funding constraints and customer requirements. Based on existing proven technology it evaluates environmental performance from a "whole building" perspective over a building's life cycle, providing a definitive standard for what constitutes a "green building". As a minimum we shall use SPiRiT to score our design and strive to meet the SPiRiT Bronze certification level. When the recommended Bronze level is not achieved, the District Project Delivery Team's Project Manager will report the issue to the MSC Program Manager and to the PM at HQUSACE with an explanation as to why this level can not be achieved. The HQUSACE PM will forward this information to Engineering Team of Technical Policy Branch, Engineering and Construction Division.

b. SPiRiT is based on accepted energy and environmental principles and strikes a balance between known effective practices and emerging concepts. Unlike other rating systems currently in existence, the development of SPiRiT uses applicable, equivalent military standards and regulations, where applicable.

c. SPiRiT is a self-evaluation system designed for the design agent and the owner to rate new and existing facilities. It is a feature-oriented system where credits are earned for satisfying each criteria. Different levels of SPiRiT certification levels are awarded based on the total credits earned. The system is designed to be comprehensive in scope, yet simple in operation.

d. For classification as a Green building, facilities must satisfy all of the prerequisites and a certain number of credits to attain different SPiRiT certification levels. Having satisfied the basic prerequisites of the rating tool, facilities are then rated according to its degree of compliance (on a percentage basis) with the credit system listed below.

e. SPiRiT is divided into eight categories: sustainable sites, water efficiency, energy and atmosphere, materials and resources, indoor environmental quality facility delivery process, current missions, and future missions. The following is a synopsis of SPiRiT.

Sustainable Sites (Score 20) SPiRiT minimizes the impact of placing a building on a site, with an eye to land use compatibility and biodiversity. It channels development to installation areas with existing infrastructure, rehabilitates damaged sites, and reduces impacts from automobile use. SPRT optimizes microclimate and minimizes effects on neighboring sites of noise, light, runoff, pollution, etc.

Water Efficiency (Score 5) SPiRiT minimizes the use of potable water for landscape irrigation and within the building.

Energy and Atmosphere (Score 28) SPiRiT ensures that buildings work as intended. It establishes energy efficiency and optimization for the base building and systems and encourages use of renewable and distributed energy systems. It reduces ozone depletion and supports early compliance with the Montreal Protocol.

Materials and Resources (Score 13) SPiRiT reduces waste from construction and building occupants and redirects recyclable material back to the manufacturing process. It extends the life cycle of existing building stock, in part by extending the life cycle of targeted building materials. It increases use of building products with recycled content material and of locally manufactured building products. It reduces depletion of finite raw materials and encourages environmentally responsible forest management.

Indoor Environmental Quality (IEQ) (Score 17) SPiRiT promotes indoor air quality (IAQ) and prevents exposure to Environmental Tobacco Smoke (ETS). It provides a high level of individual occupant control of thermal, ventilation, and lighting systems. SPiRiT provides a connection between indoor spaces and the outdoor environment through the introduction of sunlight and views into the occupied areas of the building. SPiRiT provides appropriate acoustic conditions for user privacy and comfort.

Facility Delivery Process (Score 7) SPiRiT delivers a facility that optimizes tradeoffs among sustainability, first costs, life cycle costs and mission requirements. It assures that the delivery process assures efficient operation and maintenance of the facility.

Current Mission (Score 6) SPiRiT assures that the delivery process establishes efficient operation and maintenance of the facility. It provides a high-quality, functional,

healthy, and safe work environment to promote soldier and workforce productivity and retention.

Future Missions (Score 4) SPiRiT requires an understanding of: (1) The typical or likely lifespan of the function to be accommodated by the facility in order to recognize how soon the facility should be expected to adapt to a different use; and (2) The life spans of the building systems to understand when they will need to be updated during the lifespan of the facility and to design the facility in a manner that facilitates the updating of each system. It requires design of the facility to maximize accommodation of future uses. The greater the future flexibility, the less likely it is that the facility will become a source for waste materials, or that it will require additional materials.

SPiRiT Certification Levels

SPiRiT Bronze -- 25 to 34 Points
SPiRiT Silver -- 35 to 49 Points
SPiRiT Gold -- 50 to 74 Points
SPiRiT Platinum -- 75+ Points

SPRT is designed to be an easy-to-understand EXCEL worksheet that will allow self-scoring by building delivery teams and their members, either during the charrette process or by an independent panel.

Credit Equivalence: Under certain circumstances an action will be taken that will comply with the spirit, though not necessarily the letter, of the compliance criteria. Under these circumstances, the applicant must demonstrate that the actions taken are substantially similar in impact to the relevant criteria and request credit for those actions.

f. SPiRiT is the first edition of this program. The LEED Green Building Rating System criteria will be revised no later than every 3 years. It is intended that with the future edition of LEED 3.0 in 2003 all required applicable, equivalent military standards and regulations will be addressed availing us the use of LEED 3.0 upon release in order to design and build all future facilities according to sustainable principles.

13. Corps Of Engineers Green Building Criteria Update Program

In 1994, funding was provided for a 5-year program for the Corps to develop and update technical guidance and criteria for sustainable design and construction of Army facilities. The Corps continues this effort with steady stream funding programmed for FY00-05. The Corps has taken a comprehensive, ground-up approach to sustainable design technology in military construction. The Corps philosophy is to effect a fundamental and permanent change in the way all military projects are designed and constructed as opposed to a project-by-project basis. In order to institutionalize sustainable design into Corps design procedures, we are revising current construction guide specifications (CEGS) which are used to design and construct military projects. We have called this our Green Building Criteria Update Program (GBCUP). This

provides a solid basis for incorporating a wide range of Green construction products and services into Corps projects, including:

- Floors, carpets, walls, doors, ceilings and roofing systems, including insulation and painting--Assessment of reusability, solid waste generation, and indoor air quality.
- Masonry, stucco, lathing and plastering--Environmental characteristics of recycled and composite materials.
- Metal studs in load-bearing walls as a substitute for wood.
- Scrap tire chips and cement and asphaltic concrete in pavements--Elimination and use of waste materials.
- Bottom ash used as fill, and waste materials in pavements--reusing construction waste materials.
- Recycled plastic composite railroad ties.
- Recycled site furnishings and playground equipment.
- Energy efficient HVAC controls, radiant heating systems and desiccant cooling systems.
- Water and energy conserving plumbing fixtures.

14. List of Sustainable Design and Green Building Organizations

a. Institute for Sustainable Design, University of Virginia, Charlottesville, Virginia, 22903.

b. Center for Sustainable Technology, Construction Research Center, Georgia Institute of Technology, 490 10th St NW, Atlanta, GA 30332-0519.

c. Centre for Sustainable Design, Faculty of Design, Surrey Institute of Art & Design, Falkner Road, Farnham, Surrey, GU9 7DS, United Kingdom.

d. Natural Resources Defense Council, 40 West 20th Street, New York, NY 10011.

e. U.S. Green Building Council, 90 Montgomery Street, Suite 1001, San Francisco, CA 94105.

f. Context Institute, PO Box 946, Langley, WA 98260.

g. Center of Excellence for Sustainable Development, U.S. Department of Energy, Office of Energy Efficiency and Renewable Energy, Denver Regional Support Office, 1617 Cole Boulevard, Golden, CO 80401.

h. Center for Environmental Design Research, 390 Wurster Hall, Berkeley, CA, 94720.

i. Green Building Information Council, Dr. Ray Cole, University of British Columbia, BC, Canada.

j. Design Center for Appropriate Technology, PO Box 41144 Tucson, Arizona 85717.

k. Energy Efficient Builders Association, 2950 Metro Drive, Suite 108, Minneapolis, MN, 55425.

l. Passive Solar Industries Council, 1511 K Street, NW, Suite 600, Washington DC, 20005.

m. Center for Building Science, Lawrence Berkeley National Laboratory, 1 Cyclotron Rd, Berkeley, CA 94720.

n. Sustainable Building Coalition, 3102 Breeze Terrace, Austin, TX, 78722.

o. Habitat for Humanity International, 121 Habitat Street, Americus, GA, 31709.

p. Alliance to Save Energy, 1200 18th Street, NW, Suite 900, Washington, DC, 20036.

q. American Council for an Energy-Efficient Economy, 1001 Connecticut Avenue, NW, Suite 801, Washington, D.C. 20036.

r. Geothermal Resources Council, PO Box 1350, 2001 Second Street, Suite 5, Davis, CA 95617-1350.

s. Ecology Action, 5798 Ridgewood Road, Willits, CA, 95490.

t. Rocky Mountain Institute, 1739 Snowmass Creek Road, Snowmass, Colorado 81654-9199.

APPENDIX C

SUSTAINABLE PROJECT RATING TOOL (SPiRiT)

Sustainable Project Rating Tool (SPiRiT)

Version 1.4

U. S. Army Corps of Engineers
U. S. Army Assistant Chief of Staff for Installation Management

April 2001

U. S. Army Corps of Engineers Disclaimer

The contents of this document are not to be used for advertising, publication, or promotional purposes. Citation of trade names does not constitute an official endorsement or approval of the use of such commercial products. All product names and trademarks cited are the property of their respective owners.

The findings of this document are not to be construed as an official Department of the Army position unless so designated by other authorized documents. The U. S. Army Corps of Engineers does not guarantee, certify, or ensure performance of any products, systems, strategies, or technologies described in the Sustainable Project Rating Tool (SPiRiT).

U. S. Green Building Council Disclaimer

The LEED Green Building Reference Guide™ 2.0 is the second edition, support document for the LEED Green Building Rating System™. These LEED™ documents were developed by the U.S. Green Building Council, under contract number DE-FG36-97GO10268, for the U.S. Department of Energy, Energy Efficiency and Renewable Energy, Office of Building Technology, State, and Community Programs, and are intended for use by commercial building project stakeholders or project team members as a guide for green and sustainable design. They were prepared with the assistance and participation of representatives from many organizations. The views and opinions expressed represent general consensus and available information, but unanimous approval by all organizations is not implied. The views and opinions expressed also do not necessarily state or reflect those of the United States government.

Together, the LEED™ documents represent the U.S. Green Building Council's efforts to develop a standard that improves environmental and economic performance of commercial buildings using established and/or advanced industry principles, practices, materials and standards. They are subject to change from time to time in the future.

The U.S. Green Building Council authorizes you to view the LEED Green Building Reference Guide™ 2.0 for your individual use. In exchange for this authorization, you agree to retain all copyright and other proprietary notices contained in the original LEED Green Building Reference Guide™ 2.0. You also agree not to sell or modify the LEED Green Building Reference Guide™ 2.0 or to reproduce, display or distribute the LEED Green Building Reference Guide™ 2.0 in any way for any public or commercial purpose, including display on a web site or in a networked environment. Unauthorized use of the LEED Green Building Reference Guide™ 2.0 violates copyright, trademark, and other laws and is prohibited.

Please note that the text of the federal and state codes, regulations, voluntary standards, etc. reproduced in the LEED Green Building Reference Guide™ 2.0 is either used under license to the U.S. Green Building Council or, in some instances, is in the public domain. All other text, graphics, layout, and other elements of content contained in the LEED Green Building Reference Guide™ 2.0 are owned by the U.S. Green Building Council and are protected by copyright under both United States and foreign laws.

Also please note that none of the parties involved in the funding or creation of the LEED Green Building Reference Guide™ 2.0, including the U.S. Green Building Council, its members or the United States government make any warranty (express or implied) or assume any liability or responsibility, to you or any third parties for the accuracy, completeness or use of, or reliance on, any information contained in the LEED Green Building Reference Guide™ 2.0, or for any injuries, losses or damages (including, without limitation, equitable relief) arising out of such use or reliance.

As a condition of use, you covenant not to sue, and agree to waive and release the U.S. Green Building Council, its members and the United States government from any and all claims, demands and causes of action for any injuries, losses or damages (including, without limitation, equitable relief) that you may now or hereafter have a right to assert against such parties as a result of your use of, or reliance on, the LEED Green Building Reference Guide™ 2.0.

Content

NOTES

1) This Sustainable Project Rating Tool (SPiRiT) is derived from The U. S. Green Building Council LEED 2.0 (Leadership in Energy and Environmental Design) Green Building Rating System™.

2) The SPiRiT numbering scheme parallels, but does not match LEED 2.0. LEED does not number major sections, which it calls 'Credit Categories,' ex. 'Sustainable Sites,' rather it numbers criteria or 'credits' within each major section. SPiRiT credit numbers match those of LEED where there is a 1:1 comparison. Where additional credits have been added they fall at the end of major sections.

3) The SPiRiT Credits all follow the format: Intent, Requirement and Technologies/Strategies.

Intent: A statement of the primary goal for the credit;
Requirement: Quantifiable conditions necessary to achieve stated intent;
Technologies/Strategies: Suggested technologies, strategies and referenced guidance on the means to achieve identified requirements.

4) Projects are evaluated for each SPiRiT credit which are either 'Prerequisites' or result in a point score:

Prerequisites: These credits are a statement of minimum requirements and must be met. No further points will be awarded unless the minimum is achieved. These credits are recognizable by an 'R' in the number scheme, ex. 1.R1, and a 'Reqd.' in the score column.
Point Score: These credits are evaluated and result in a point score. Where the potential score is greater than 1, no partial points are granted.

5) SPiRiT Sustainable Project Certification Levels:

SPiRiT Bronze	25 to 34 Points
SPiRiT Silver	35 to 49 Points
SPiRiT Gold	50 to 74 Points
SPiRiT Platinum	75 to 100 Points

6) SPiRiT credits have been developed to address facility life cycle phases including programming, design, construction, and commissioning. Additional rating tools will be developed to address installation/base master planning and facilities operations and maintenance, rehabilitation, recycling, and disposal.

7) POC for U. S. Army Corps of Engineers:

Mr. Harry Goradia
U. S. Army Corps of Engineers
ATTN: CEMP-ET
7701 Telegraph Road
Alexandria, VA 22315-3862
Phone 703-428-6460, FAX 703-428-7903
Email harry.goradia@hq02.usace.army.mil

POC for U. S. Army Installations:

Mr. John Scharl
U. S. Army Assistant Chief of Staff for Installation Management, Directorate of Facilities & Housing
ATTN: DAIM-FDF
7701 Telegraph Road, Bldg #2594 (Room 146B),
Alexandria, VA 22315-3800
Phone (703) 428-7614, FAX (703) 428-0197
Email scharja@hqda.army.mil

8) Sustainable Project Rating Tool (SPiRiT) Authors are:
Stephen N. Flanders (Lead), U. S. Army Engineering Research & Development Center (ERDC-CRREL)
Richard L. Schneider, U. S. Army Engineering Research & Development Center (ERDC-CERL)
Donald Fournier, U. S. Army Engineering Research & Development Center (ERDC-CERL)
Annette Stumpf, U. S. Army Engineering Research & Development Center (ERDC-CERL)

9) Army/USACE employees are members of the USGBC with membership privileges accessible via the USGBC web site, http://www.usgbc.org. For information on membership and access to available LEED resources to support use of SPiRiT and sustainable design in your projects, contact Richard Schneider at (217) 373-6752 or richard.l.schneider@erdc.usace.army.mil (Annette Stumpf at (217) 352-6511 ext. 7542 or annette.l.stumpf@erdc.usace.army.mil alternate).

10) For the latest information on SPiRiT and for access to guidance, tools and resources supporting sustainable design initiatives, visit the CERL 'Sustainable Design and Development Resource' website, http://www.cecer.army.mil/SustDesign. There you may also join the CERL Sustainable Design ListServ to be directly notified of information pertinent to sustainable design.

1.0 Sustainable Sites — Score 20

1.R1 **Erosion, Sedimentation, and Water Quality Control** [1] **Reqd.**

Intent: Control erosion and pollutants to reduce negative impacts on water and air quality.

Requirement:

- ☐ Design a site sediment and erosion control plan and a pollution prevention plan that conforms to best management practices in the EPA's Storm Water Management for Construction Activities, EPA Document No. EPA-833-R-92-001, Chapter 3, OR local Erosion and Sedimentation Control standards and codes, whichever is more stringent. The plan shall meet the following objectives:
  - Prevent loss of soil during construction by storm water runoff and/or wind erosion, including protecting topsoil by stockpiling for reuse.
  - Prevent sedimentation of storm sewer or receiving streams and/or air pollution with dust and particulate matter.
  - Prevent hazardous material discharge into storm water systems.
  - Prevent petroleum oils and lubricants (POL) discharge into storm water systems.

Technologies /Strategies: The EPA standard lists numerous measures such as silt fencing, sediment traps, oil grit separators, construction phasing, stabilization of steep slopes, maintaining vegetated ground cover and providing ground cover that will meet this prerequisite.

1.C1 **Site Selection** [1]

Intent: Avoid development of inappropriate sites and reduce the environmental impact from the location of a building on a site. Select site based on functional adjacencies/relationships and land use compatibility.

Requirement:

- ☐ Do not develop buildings on portions of sites that meet any one of the following criteria: **1**
  - Prime training or maneuver land.
  - Land whose elevation is lower than 5 ft. above the 100-year flood elevation as defined by FEMA.
  - Land that provides habitat for any species on the Federal or State threatened or endangered list.
  - Within 100 feet of any wetland as defined by 40 CFR, Parts 230-233 and Part 22, OR as defined by local or state rule or law, whichever is more stringent.
- ☐ Select site based on functional adjacencies/relationships and land use compatibility. **1**
  - Select sites close to existing roads and utilities or use an existing structure to minimize the need for new infrastructure.
  - Select site in area of high density.
  - Site facilities based on the strength of their relationships to other facilities/land-uses to limit travel distances. The stronger the relationship/functional interaction, the closer the distance between two facilities.
  - Select for distance to installation/base transit systems and access to pedestrian ways and bike paths.
  - Select for development previously used or developed suitable and available sites.

Technologies /Strategies: Screen potential building sites for these criteria and/or ensure that these criteria are addressed by the designer during the conceptual design phase. Utilize landscape architects, ecologists, environmental engineers, civil engineers, and similar professionals for the screening process. New wetlands constructed as part of stormwater mitigation or other site restoration efforts are not affected by the restrictions of this prerequisite.

---

[1] Adapted material not reviewed or endorsed by U. S. Green Building Council.

1.0 Sustainable Sites (Continued)

1.C2 **Installation/Base Redevelopment** [1]

Intent: Channel development to installation/base cantonment areas with existing infrastructure, protecting greenfields and preserving habitat and natural resources.

Requirement:

- ☐ Increase localized density to conform to existing or desired density goals by utilizing sites that are located within existing cantonment areas of high development density. **1**
- ☐ Select sites close to existing roads and utilities or use an existing structure to minimize the need for new infrastructure. **1**

Technologies /Strategies: During the site selection process give preference to previously developed sites with installation/base cantonment redevelopment potential such as facility reduction program cleared sites.

1.C3 **Brownfield Redevelopment** [1]

Intent: Rehabilitate damaged sites where development is complicated by real or perceived environmental contamination, reducing pressure on undeveloped land.

Requirement:

- ☐ Develop on a site classified as a brownfield and provide remediation as required by EPA's Brownfield Redevelopment program requirements OR Develop a brownfield site (a site that has been contaminated by previous uses). **1**

Technologies /Strategies: Screen potential damaged sites for these criteria prior to selection for rehabilitation.

Utilize EPA OSWER Directive 9610.17 and ASTM Standard Practice E1739 for site remediation where required.

1.C4 **Alternative Transportation** [1]

Intent: Reduce pollution and land development impacts from automobile use.

Requirement:

- ☐ Locate building within ½ mile of installation/base transit systems. **1**
- ☐ Provide suitable means for securing bicycles, with convenient changing/shower facilities for use by cyclists, for 5% or more of building occupants. **1**
- ☐ Locate building within 2 miles of alternative-fuel refueling station(s). **1**
- ☐ Size parking capacity not to exceed minimum installation/base cantonment requirements AND provide preferred parking for carpools or van pools capable of serving 5% of the building occupants, OR, add no new parking for rehabilitation projects AND provide preferred parking for carpools or van pools capable of serving 5% of the building occupants. **1**

Technologies /Strategies: Select sites near public installation/base transit served by safe, convenient pedestrian pathways.

---

[1] Adapted material not reviewed or endorsed by U. S. Green Building Council.

1.C5 **Reduced Site Disturbance** [1]

Intent: Conserve existing natural areas and restore damaged areas to provide habitat and promote biodiversity.

Requirement:

- ☐ On greenfield sites, limit site disturbance including earthwork and clearing of vegetation to 40 feet beyond the building perimeter, 5 feet beyond primary roadway curbs, walkways, and main utility branch trenches, and 25 feet beyond pervious paving areas that require additional staging areas in order to limit compaction in the paved area; OR, on previously developed sites, restore a minimum of 50% of the remaining open area by planting native or adapted vegetation. **1**

- ☐ Reduce the development footprint (including building, access roads and parking) to exceed the installation/base's/base's master plan local zoning's open space requirement for the site by 25% or in accordance with installation/base policy on open space set asides, whichever is greater. **1**

Technologies /Strategies: Note requirements on plans and in specifications. Establish contractual penalties for destruction of trees and site areas noted for protection. Reduce footprints by tightening program needs and stacking floor plans. Establish clearly marked construction and disturbance boundaries. Delineate laydown, recycling, and disposal areas. Use areas to be paved as staging areas. Work with local horticultural extension services, ~~or~~ native plant societies, or installation/base agronomy staff to select indigenous plant species for site restoration and landscaping.

1.C6 **Stormwater Management** [1]

Intent: Limit disruption of natural water flows by minimizing storm water runoff, increasing on-site infiltration and reducing contaminants.

Requirement: Implement a stormwater management plan that results in:

- ☐ No net increase in the rate or quantity of stormwater runoff from undeveloped to developed conditions; OR, if existing imperviousness is greater than 50%, implement a stormwater management plan that results in a 25% decrease in the rate and quantity of stormwater runoff. **1**

- ☐ Treatment systems designed to remove 80% of the average annual post development total suspended solids (TSS), and 40% of the average annual post development total phosphorous (TP), by implementing Best Management Practices (BMPs) outlined in EPA's Guidance Specifying Management Measures for Sources of Nonpoint Pollution in Coastal Waters (EPA-840-B-92-002 1/93). **1**

Technologies /Strategies: Significantly reduce impervious surfaces, maximize on-site stormwater infiltration, and retain pervious and vegetated areas. Capture rainwater from impervious areas of the building for groundwater recharge or reuse within building. Use green/vegetated roofs. Utilize biologically-based and innovative stormwater management features for pollutant load reduction such as constructed wetlands, stormwater filtering systems, bioswales, bio-retention basins, and vegetated filter strips. Use open vegetated swales to reduce drainage velocity and erosion, reduce system maintenance, increase vegetative variety and support wildlife habitat where space permits.

1.C7 **Landscape and Exterior Design to Reduce Heat Islands** [2]

Intent: Reduce heat islands (thermal gradient differences between developed and undeveloped areas) to minimize impact on microclimate and human and wildlife habitat.

Requirement:

- ☐ Provide shade (within 5 years) on at least 30% of non-roof impervious surface on the site, including parking lots, walkways, plazas, etc., OR, use light-colored/ high-albedo materials (reflectance of at least 0.3) for 30% of the site's non-roof impervious surfaces, OR place a minimum of 50% of parking space under-ground OR use open-grid pavement system (net impervious area of LESS than 50%) for a minimum of 50% of the parking lot area. **1**

- ☐ Use ENERGY STAR Roof compliant, high-reflectance AND low emissivity roofing (initial reflectance of at least .65 and three-year-aged reflectance of at least .5 when tested in accordance with ASTM E408) for a minimum of 75% of the roof surface; OR, install a "green" (vegetated) roof for at least 50% of the roof area. **1**

Technologies /Strategies: Employ design strategies, materials, and landscaping designs that reduce heat absorption of exterior materials. Note albedo/reflectance requirements in the drawings and specifications. Provide shade (calculated on June 21, noon solar time) using native or climate tolerant trees and large shrubs, vegetated trellises, or other exterior structures supporting vegetation. Substitute vegetated surfaces for hard surfaces. Explore elimination of blacktop and the use of new coatings and integral colorants for asphalt to achieve light colored surfaces.

---

[1] Adapted material not reviewed or endorsed by U. S. Green Building Council.

[2] © U. S. Green Building Council. Used by permission.

1.0 Sustainable Sites (Continued)

1.C8 **Light Pollution Reduction** [1]

Intent: Eliminate light trespass from the building site, improve night sky access, and reduce development impact on nocturnal environments.

Requirement: ❑ Do not exceed Illuminating Engineering Society of North America (IESNA) footcandle level requirements as stated in the Recommended Practice Manual: Lighting for Exterior Environments, AND design interior and exterior lighting such that zero direct-beam illumination leaves the building site. **1**

Technologies /Strategies: Consult IESNA Recommended Practice Manual: Lighting for Exterior Environments for Commission Internationle de l'Eclairage (CIE) zone and pre and post curfew hour descriptions and associated ambient lighting level requirements. Ambient lighting for pre-curfew hours for CIE zones range between .01 footcandles for areas with dark landscapes such as parks, rural, and residential areas, and 1.5 footcandles for areas with high ambient brightness such as installation/base areas with high levels of nighttime activity. Design site lighting and select lighting styles and technologies to have a minimal impact off-site and minimal contribution to sky glow. Minimize lighting of architectural and landscape features. Exterior lighting should be consistent with security lighting requirements.

1.C9 **Optimize Site Features**

Intent: Optimize utilization of the site's existing natural features and placement of man-made features on the site.

Requirement: ❑ Perform both of the following: **1**

- Maximize the use of free site energy.
- Plan facility, parking and roadways to "fit" existing site contours and limit cut and fill.

Technologies /Strategies: Evaluate site resources to ascertain how each can enhance the proposed project and visa versa. Work to maximum advantage of the site's solar and wind attributes. Use landscaping to optimize solar and wind conditions and to contribute to energy efficiency; Locate and orient the facility on the site to optimize solar and wind conditions.

1.C10 **Facility Impact**

Intent: Minimize negative impacts on the site and on neighboring properties and structures; avoid or mitigate excessive noise, shading on green spaces, additional traffic, obscuring significant views, etc.

Requirement: ❑ Cluster facilities to reduce impact, access distance to utilities and sufficient occupant density to support mass transit. **1**

❑ Collaborate with installation/base and community planners to identify and mitigate potential impacts of the project beyond site boundaries, and transportation planners to insure efficient public transport. **1**

Technologies /Strategies: Involve local/regional planners and community members in installation/base master planning processes. Recognize the context and the impact of a project beyond site boundaries, and integrate it with the larger installation/base/community context/land use.

1.C11 **Site Ecology**

Intent: Identify and mitigate all existing site problems including contamination of soil, water, and air, as well as any negative impacts caused by noise, eyesores, or lack of vegetation, enhancing or creating new site habitat.

Requirement: ❑ Develop site environmental management and mitigation plan. **1**

Technologies /Strategies: Understand site and surrounding ecosystem interdependence and interconnectivity. Plan landscaping scheme to incorporate biodiversity. Preserve/enhance existing trees, hydrological features, ecosystems, habitats, and cultural resources. Increase the existence of healthy habitat for native species. Reintroduce native plants and trees where they have been destroyed by previous development.

---

[1] Adapted material not reviewed or endorsed by U. S. Green Building Council.

2.0 Water Efficiency — Score 5

2.C1 **Water Efficient Landscaping** [2]

Intent: Limit or eliminate the use of potable water for landscape irrigation.

Requirement:

- ☐ Use high efficiency irrigation technology, OR, use captured rain or recycled site water to reduce potable water consumption for irrigation by 50% over conventional means. **1**
- ☐ Use only captured rain or recycled site water for an additional 50% reduction (100% total reduction) of potable water for site irrigation needs, OR, do not install permanent landscape irrigation systems. **1**

Technologies /Strategies: Develop a landscaping water use baseline according to the methodology outlined in the LEED Reference Guide. Specify water-efficient, native or adapted, climate tolerant plantings. High efficiency irrigation technologies include micro irrigation, moisture sensors, or weather data based controllers. Feed irrigation systems with captured rainwater, gray water, or on-site treated wastewater.

2.C2 **Innovative Wastewater Technologies** [2]

Intent: Reduce generation of wastewater and potable water demand, while increasing local aquifer recharge.

Requirement:

- ☐ Reduce the use of municipally provided potable water for building sewage conveyance by a minimum of 50%, OR, treat 100% of wastewater on site to tertiary standards. **1**

Technologies /Strategies: Develop a wastewater baseline according to the methodology outlined in the LEED Reference Guide. Implement decentralized on-site wastewater treatment and reuse systems. Decrease the use of potable water for sewage conveyance by utilizing gray and/or black water systems. Non-potable reuse opportunities include, toilet flushing, landscape irrigation, etc. Provide advanced wastewater treatment after use by employing innovative, ecological, on-site technologies including constructed wetlands, a mechanical recirculating sand filter, or aerobic treatment systems.

2.C3 **Water Use Reduction** [1]

Intent: Maximize water efficiency within buildings to reduce the burden on municipal water supply and wastewater systems.

Requirement:

- ☐ Employ strategies that in aggregate use 20% less water than the water use baseline calculated for the building (not including irrigation) after meeting Energy Policy Act (EPACT) of 1992 fixture performance requirements. **1**
- ☐ Exceed the potable water use reduction by an additional 10% (30% total efficiency increase). **1**

Technologies /Strategies: Develop a water use baseline including all water consuming fixtures, equipment, and seasonal conditions according to methodology guidance outlined in the LEED Reference Guide. Specify water conserving plumbing fixtures that exceed Energy Policy Act (EPACT) of 1992 fixture requirements in combination with ultra high efficiency or dry fixture and control technologies. Specify high water efficiency equipment (dishwashers, laundry, cooling towers, etc.). Use alternatives to potable water for sewage transport water. Use recycled or storm water for HVAC/process make up water. Install cooling tower systems designed to minimize water consumption from drift, evaporation and blowdown.

---

[2] © U. S. Green Building Council. Used by permission.

[1] Adapted material not reviewed or endorsed by U. S. Green Building Council.

3.R1 **Fundamental Building Systems Commissioning** [1] **Reqd.**

Intent: Verify and ensure that fundamental building elements and systems are designed, installed and calibrated to operate as intended.

Requirement: ☐ Implement all of the following fundamental best practice commissioning procedures.

- Engage a commissioning authority.
- Develop design intent and basis of design documentation.
- Include commissioning requirements in the construction documents.
- Develop and utilize a commissioning plan.
- Verify installation, functional performance, training and documentation.
- Complete a commissioning report.

Technologies /Strategies: Introduce standards and strategies into the design process early, and then carry through selected measures by clearly stating target requirements in the construction documents. Tie contractor final payments to documented system performance. Perform additional commissioning in accordance with the DOE Building Commissioning Guide, Version 2.2. Refer to the LEED Reference Guide for detailed descriptions of required elements and references to additional commissioning guides. Specify pre-occupancy baseline IAQ testing at time of commissioning. Test for indoor air concentrations of CO, CO2, total VOCs and particulates. Test to assure that adequate ventilation rates have been achieved prior to initial occupancy.

3.R2 **Minimum Energy Performance** [1] **Reqd.**

Intent: Establish the minimum level of energy efficiency for the base building and systems.

Requirement: ☐ Design to meet building energy efficiency and performance as required by TI 800-01 (Design Criteria).

Technologies /Strategies: Use building modeling and analysis techniques to establish and document compliance. ASHRAE/IESNA 90.1-1999 provides guidance for establishing building base case development and analysis. Refer to the LEED Reference Guide for a wide variety of energy efficiency strategy resources.

Use a professionally recognized and proven computer program or programs that integrate architectural features with air-conditioning, heating, lighting, and other energy producing or consuming systems. These programs will be capable of simulating the features, systems, and thermal loads used in the design. Using established weather data files, the program will perform 8760 hourly calculations. BLAST, DOE-2 or EnergyPlus are acceptable programs for these purposes.

3.R3 **CFC Reduction in HVAC&R Equipment** [2] **Reqd.**

Intent: Reduce ozone depletion.

Requirement: ☐ Zero use of CFC-based refrigerants in new base building HVAC&R systems. When reusing existing base building HVAC equipment, complete a comprehensive CFC phaseout conversion.

Technologies /Strategies: Specify only non-CFC-based refrigerants in all base building HVAC&R systems.

---

[1] Adapted material not reviewed or endorsed by U. S. Green Building Council.

[2] © U. S. Green Building Council. Used by permission.

3.0 Energy and Atmosphere (Continued)

3.C1 **Optimize Energy Performance** [1]

Intent: Achieve increasing levels of energy performance above the prerequisite standard to reduce environmental impacts associated with excessive energy use.

Requirement:

- ☐ Reduce design energy usage (DEU) compared to the energy use budget (EUB) in joules per square meter per year for regulated energy components as described in the requirements of Chapter 11 of the TI 800-01 (Design Criteria), as demonstrated by a whole building simulation. **20**
  - 1 Point will be awarded for every reduction in design energy use of 2.5% for both new and existing facilities for a maximum score of 20 points.

Regulated energy components include HVAC systems, building envelope, service hot water systems, lighting and other regulated systems as defined by ASHRAE.

Technologies /Strategies: Develop and use building modeling and analysis techniques to establish a base case that meets the minimum prerequisite standard. ASHRAE/IESNA 90.1-1999 provides guidance for establishing building base case development and analysis. Perform interactive energy use analysis for selected design elements that affect energy performance and document compliance.

Unit of measure for performance shall be annual energy usage in joules per square meter. Life-Cycle energy costs shall be determined using rates for purchased energy, such as electricity, gas, oil, propane, steam, and chilled water and approved by the adopting authority. Refer to the LEED Reference Guide or Whole Building Design Guide for a wide variety of energy efficiency resources and strategies including conservation measures, electromechanical energy efficiency technologies (for example ground-source heat pumps), passive heating and cooling strategies, solar hot water, and daylighting.

Life-Cycle costing will be done in accordance with 10 CFR 436.

Consider installation of an Energy Management and Control System (EMCS), which is compatible with exiting installation systems to optimize performance. Use sensors to control loads based on occupancy, schedule and/or the availability of natural resources use (day light or natural ventilation).

3.C2 **Renewable Energy** [1]

Intent: Encourage and recognize increasing levels of self-supply through renewable technologies to reduce environmental impacts associated with fossil fuel energy use.

Requirement:

- ☐ Supply a net fraction of the building's total energy use through the use of on-site renewable energy systems.

% of Total Annual Energy Usage in Renewables	
5%	1
10%	2
15%	3
20%	4

Technologies /Strategies: Employ the use of on-site non-polluting-source renewable technologies contributing to the total energy requirements of the project. Consider and use high temperature solar and/or geothermal, photovoltaics, wind, biomass (other than unsustainably harvested wood), and bio-gas. Passive solar, solar hot water heating, ground-source heat pumps, and daylighting do not qualify for points under this credit. Credit for these strategies is given in Energy & Atmosphere Credit 1: Optimizing Energy Performance.

---

[1] Adapted material not reviewed or endorsed by U. S. Green Building Council.

3.C3 **Additional Commissioning** [2]

Intent: Verify and ensure that the entire building is designed, constructed, and calibrated to operate as intended.

Requirement: ☐ In addition to the Fundamental Building Commissioning prerequisite, implement the following additional commissioning tasks: **1**

1. Conduct a focused review of the design prior to the construction documents phase.
2. Conduct a focused review of the construction documents when close to completion.
3. Conduct a selective review of contractor submittals of commissioned equipment.
4. Develop a system and energy management manual.
5. Have a contract in place for a near-warranty end or post occupancy review.

Items 1, 2, and 3 must be performed by someone other than the designer.

Technologies /Strategies: Introduce standards and strategies into the design process early, and then carry through selected measures by clearly stating target requirements in the construction documents. Tie contractor final payments to documented system performance. Refer to the LEED Reference Guide for detailed descriptions of required elements and references to additional guidelines.

3.C4 **<< Deleted >>** [1]

3.C5 **Measurement and Verification** [1]

Intent: Provide for the ongoing accountability and optimization of building energy and water consumption performance over time.

Requirement: ☐ Comply with the installed equipment requirements for continuous metering as stated in selected Measurement and Verification Methods - Option B: Retrofit Isolation of the US DOE's International Performance Measurement and Verification Protocol (IPMVP) for the following: **1**

- Lighting systems and controls.
- Constant and variable motor loads.
- Variable frequency drive (VFD) operation.
- Chiller efficiency at variable loads (kW/ton).
- Cooling load.
- Air and water economizer and heat recovery cycles.
- Air distribution static pressures and ventilation air volumes.
- Boiler efficiencies.
- Building specific process energy efficiency systems and equipment.
- Indoor water risers and outdoor irrigation systems.

Technologies /Strategies: Design and specify equipment to be installed in base building systems to allow for comparison, management, and optimization of actual vs. estimated energy and water performance. Employ building automation systems to perform M&V functions where applicable. Tie contractor final payments to documented M&V system performance and include in the commissioning report. Provide for ongoing M&V system maintenance and operating plan in building operations and maintenance manuals. Consider installation/base of an Energy Management and Control System (EMCS), which is compatible with exiting installation/base systems to optimize performance.

---

[2] © U. S. Green Building Council. Used by permission.

[1] Adapted material not reviewed or endorsed by U. S. Green Building Council.

3.C6 **Green Power** [1]

Intent: Encourage the development and use of grid-source, renewable energy technologies on a net zero pollution basis.

Requirement: ☐ Engage in a two year contract to purchase the amount of power equal to projected building consumption generated from renewable sources that meet the Center for Resource Solutions (CRS) Green-E requirements. **1**

Technologies /Strategies: Purchase power from a provider that guarantees a fraction of its delivered electric power is from net nonpolluting renewable technologies. Begin by contacting local utility companies. If the project is in an open market state, investigate Green Power and Power Marketers licensed to provide power in that state. Grid power that qualifies for this credit originates from solar, wind, geothermal, biomass, or low-impact hydro sources. Low-impact hydro shall comply with the Low Impact Hydropower Certification Program.

3.C7 **Distributed Generation**

Intent: Encourage the development and use of distributed generation technologies, which are less polluting than grid-source energy.

Requirement: ☐ Reduce total energy usage and emissions by considering source energy implications and local cogeneration and direct energy conversion. Generate at least 50% of the building's projected annual consumption by on-site distributed generation sources. **1**

Technologies /Strategies: Investigate the use of integrated generation and delivery systems, such as co-generation, fuel cells, micro-turbines and off-peak thermal storage.

[1] Adapted material not reviewed or endorsed by U. S. Green Building Council.

4.0 Materials and Resources — Score 13

4.R1 **Storage & Collection of Recyclables** [1] **Reqd.**

Intent: Facilitate the reduction of waste generated by building occupants that is hauled to and disposed of in landfills.

Requirement:

- ☐ Provide an easily accessible area that serves the entire building that is dedicated to the separation, collection and storage of materials for recycling including (at a minimum) paper, glass, plastics, and metals.

Technologies /Strategies: Establish a waste management plan which meets requirements of the installation/base environmental and/or solid waste management plans in cooperation with users to encourage recycling. Reserve space for recycling functions early in the building occupancy programming process and show areas dedicated to collection of recycled materials on space utilization plans. Broader recycling support space considerations should allow for collection and storage of the required elements and newspaper, organic waste (food and soiled paper), and dry waste. When collection bins are used, bin(s) should be able to accommodate a 75% diversion rate and be easily accessible to custodial staff and recycling collection workers. Consider bin designs that allow for easy cleaning to avoid health issues.

4.C1 **Building Reuse** [1]

Intent: Extend the life cycle of existing building stock, conserve resources, retain cultural resources, reduce waste, and reduce environmental impacts of new buildings as they relate to materials manufacturing and transport.

Requirement: Reuse large portions of existing structures during renovation or redevelopment projects.

- ☐ Maintain at least 75% of existing building structure and shell (exterior skin and framing excluding window assemblies). **1**
- ☐ Maintain an additional 25% (100% total) of existing building structure and shell (exterior skin and framing excluding window assemblies). **1**
- ☐ Maintain 100% of existing building structure and shell AND 50% non-shell (walls, floor coverings, and ceiling systems). **1**

Technologies /Strategies: Evaluate retention of existing structure. Consider facade preservation, particularly in installation/base areas. During programming and space planning, consider adjusting needs and occupant use patterns to fit within existing building structure and interior partition configurations. Identify and effectively address energy, structural, and indoor environmental (lead & asbestos) issues in building reuse planning and deconstruction documents. Percentage of reused non-shell building portions will be calculated as the total area (s.f.) of reused walls, floor covering, and ceiling systems, divided by the existing total area (s.f.) of walls, floor covering, and ceiling systems.

4.C2 **Construction Waste Management** [1]

Intent: Divert construction, demolition, and land clearing debris from landfill disposal. Redirect recyclable material back to the manufacturing process.

Requirement: Develop and implement a waste management plan, quantifying material diversion by weight:

- ☐ Recycle and/or salvage at least 50% (by weight) of construction, demolition, and land clearing waste. **1**
- ☐ Recycle and/or salvage an additional 25% (75% total by weight) of the construction, demolition, and land clearing debris. **1**

Technologies /Strategies: Develop and specify a waste management plan which meets requirements of the installation/base environmental and/or solid waste management plans that identifies licensed haulers and processors of recyclables; identifies markets for salvaged materials; employs deconstruction, salvage, and recycling strategies and processes, includes waste auditing; and documents the cost for recycling, salvaging, and reusing materials. Source reduction on the job site should be an integral part of the plan.

The plan should address recycling of corrugated cardboard, metals, concrete brick, asphalt, land clearing debris (if applicable), beverage containers, clean dimensional wood, plastic, glass, gypsum board, and carpet; evaluate the cost-effectiveness of recycling rigid insulation, engineered wood products and other materials; hazardous materials storage and management; and participation in manufacturers' "take-back" programs to the maximum extent possible. Refer to the LEED Reference Guide for guidelines and references that provide waste management plan development and implementation support including model bid specifications.

---

[1] Adapted material not reviewed or endorsed by U. S. Green Building Council.

4.C3 **Resource Reuse** [2]

Intent: Extend the life cycle of targeted building materials, reducing environmental impacts related to materials manufacturing and transport.

Requirement:

- ☐ Specify salvaged or refurbished materials for 5% of building materials. **1**
- ☐ Specify salvaged or refurbished materials for 10% of building materials. **1**

Technologies /Strategies: Commonly salvaged building materials include wood flooring/ paneling/cabinets, doors and frames, mantels, iron work and decorative lighting fixtures, brick, masonry and heavy timbers. See the LEED Reference Guide for calculation tools and guidelines. Determine percentages in terms of dollar value using the following steps:

1. Calculate total dollars* (see exclusions) of the salvaged or refurbished material.
2. Calculate total dollars (see exclusions) of all building materials.
3. Divide Step 1 by Step 2 to determine the percentage.

Exclusions: In total dollar calculations, exclude; labor costs; all mechanical and electrical material and labor costs and project overhead and fees. *If the cost of the salvaged or refurbished material is below market value, use replacement cost to estimate the material value, otherwise use actual cost to the project.

4.C4 **Recycled Content** [1]

Intent: Increase demand for building products that have incorporated recycled content material, reducing the impacts resulting from extraction of new material.

Requirement:

- ☐ Specify a minimum of 25% of building materials that contain in aggregate a minimum weighted average of 20% post-consumer recycled content material, OR, a minimum weighted average of 40% post-industrial recycled content material. **1**
- ☐ Specify an additional 25% (50% total) of building materials that contain in aggregate, a minimum weighted average of 20% post consumer recycled content material, OR, a minimum weighted average of 40% post-industrial recycled content material. **1**

Technologies /Strategies: Specify building materials containing recycled content for a fraction of total building materials. Select products and materials with supporting information from the AIA Resource Guide or the EPA Environmentally Preferable Purchasing (EPP) Program. Common building materials and products with recycled content include; wall, partition, and ceiling materials and systems; insulation; tiles and carpets; cement, concrete, and reinforcing metals; structural and framing steel. For products/materials not listed, selection should be made on the basis of EPP criterion and/or:

- Toxicity;
- Embodied energy;
- Production use of water, energy and ozone depleting substances (ODSs);
- Production limits on toxic emissions and effluents;
- Minimal, reusable or recycled/recyclable packaging;
- Impact on indoor environmental quality (IEQ);
- Installation that limits generation of waste;
- Materials that limit waste generation over their life;
- EPA guideline compliance; and
- Harvested on a sustainable yield basis.

See the LEED Reference Guide for a summary of the EPA guidelines and calculation methodology guidelines. Determine percentages in terms of dollar value using the following steps:

1. Calculate total dollars (see exclusions) of the material that contain recycled content.
2. Calculate total dollars (see exclusions) of all building materials.
3. Divide Step 1 by Step 2 to determine the percentage.

Exclusions: Labor costs; all mechanical and electrical material and labor costs; project overhead and fees)

---

[2] © U. S. Green Building Council. Used by permission.

[1] Adapted material not reviewed or endorsed by U. S. Green Building Council.

4.C5 **Local/Regional Materials** [2]

Intent: Increase demand for building products that are manufactured locally, reducing the environmental impacts resulting from transportation, and supporting the local economy.

Requirement:

- ☐ Specify a minimum of 20% of building materials that are manufactured regionally within a radius of 500 miles. **1**
- ☐ Of these regionally manufactured materials, specify a minimum of 50% that are extracted, harvested, or recovered within 500 miles. **1**

Technologies /Strategies: Specify and install regionally extracted, harvested, and manufactured building materials. Contact the state and local waste management boards for information about regional building materials. See the LEED Reference Guide for calculation methodology guidelines. Determine percentages in terms of dollar value using the following steps:

1. Calculate total dollars (see exclusions) of material that is locally or regionally manufactured.
2. Calculate total dollars (see exclusions) of all building materials.
3. Divide Step 1 by Step 2 to determine the percentage.

Exclusions: Labor costs; all mechanical and electrical material and labor costs; project overhead and fees.

4.C6 **Rapidly Renewable Materials** [2]

Intent: Reduce the use and depletion of finite raw and long cycle renewable materials by replacing them with rapidly renewable materials.

Requirement:

- ☐ Specify rapidly renewable building materials for 5% of total building materials. **1**

Technologies /Strategies: Rapidly renewable resources are those materials that substantially replenish them-selves faster than traditional extraction demand (e.g. planted and harvested in less than a 10 year cycle) and do not result in significant biodiversity loss, increase erosion, air quality impacts, and that are sustainably managed. See the LEED Reference Guide for calculation methodology guidelines. Determine percentages in terms of dollar value using the following steps:

1. Calculate total dollars (see exclusions) of materials that are considered to be rapidly renewable.
2. Calculate total dollars (see exclusions) of all building materials.
3. Divide Step 1 by Step 2 to determine the percentage.

Exclusions: Labor costs; all mechanical and electrical material and labor costs; project overhead and fees.

4.C7 **Certified Wood** [2]

Intent: Encourage environmentally responsible forest management.

Requirement:

- ☐ Use a minimum of 50% of wood-based materials certified in accordance with the Forest Stewardship Council guidelines for wood building components including but not limited to framing, flooring, finishes, furnishings, and non-rented temporary construction applications such as bracing, concrete form work and pedestrian barriers. **1**

Technologies /Strategies: Refer to the Forest Stewardship Council guidelines for wood building components that qualify for compliance to the requirements and incorporate into material selection for the project.

---

[2]

5.R1 **Minimum IAQ Performance** [1] **Reqd.**

Intent: Establish minimum IAQ performance to prevent the development of indoor air quality problems in buildings, maintaining the health and well being of the occupants.

Requirement: ☐ Meet the minimum requirements of voluntary consensus standard ASHRAE 62-1999, Ventilation for Acceptable Indoor Air Quality and approved Addenda.

Technologies /Strategies: Include proactive design details that will eliminate some of the common causes of indoor air quality problems in buildings. Introduce standards into the design process early. Incorporate references to targets in plans and specifications. Ensure ventilation system outdoor air capacity can meet standards in all modes of operation. Locate building outdoor air intakes (including operable windows) away from potential pollutants/contaminant sources such as sporulating plants (allergens), loading areas, building exhaust fans, cooling towers, sanitary vents, dumpsters, vehicular exhaust, and other sources. Include operational testing in the building commissioning report. Design cooling coil drain pans to ensure complete draining. Include measures to control and mitigate radon buildup in areas where it is prevalent. Limit humidity to a range that minimizes mold growth and promotes respiratory health.

5.R2 **Environmental Tobacco Smoke (ETS) Control** [2] **Reqd.**

Intent: Prevent exposure of building occupants and systems to Environmental Tobacco Smoke (ETS).

Requirement: ☐ Zero exposure of nonsmokers to ETS by prohibition of smoking in the building, OR, by providing a designated smoking room designed to effectively contain, capture and remove ETS from the building. At a minimum, the smoking room shall be directly exhausted to the outdoors with no recirculation of ETS-containing air to the non-smoking area of the building, enclosed with impermeable structural deck-to-deck partitions and operated at a negative pressure compared with the surrounding spaces of at least 7 Pa (0.03 inches of water gauge). Performance of smoking rooms shall be verified using tracer gas testing methods as described in ASHRAE Standard 129-1997. Acceptable exposure in non-smoking areas is defined as less than 1% of the tracer gas concentration in the smoking room detectable in the adjoining non-smoking areas. Smoking room testing as described in the ASHRAE Standard 129-1997 is required in the contract documents and critical smoking facility systems testing results must be included in the building commissioning plan and report or as a separate document.

Technologies /Strategies: Prohibit smoking in the building and/or provide designated smoking areas outside the building in locations where ETS cannot reenter the building or ventilation system and away from high building occupant or pedestrian traffic.

5.C1 **IAQ Monitoring** [1]

Intent: Provide capacity for indoor air quality (IAQ) monitoring to sustain long term occupant health and comfort.

Requirement: ☐ Install a permanent carbon dioxide (CO_2) monitoring system that provides feedback on space ventilation performance in a form that affords operational adjustments, AND specify initial operational set point parameters that maintain indoor carbon dioxide levels no higher than outdoor levels by more than 530 parts per million at any time. **1**

Technologies /Strategies: Install an independent system or make CO_2 monitoring a function of the building automation system. Situate monitoring locations in areas of the building with high occupant densities and at the ends of the longest runs of the distribution ductwork. Specify that system operation manuals require calibration of all of the sensors per manufacturer recommendations but not less than one year. Include sensor and system operational testing and initial set point adjustment in the commissioning plan and report. Also consider periodic monitoring of carbon monoxide (CO), total volatile organic compounds (TVOCs), and particulates (including PM10).

---

[1] Adapted material not reviewed or endorsed by U. S. Green Building Council.

[1] Adapted material not reviewed or endorsed by U. S. Green Building Council.

5.C2 **Increase Ventilation Effectiveness** [2]

Intent: Provide for the effective delivery and mixing of fresh air to building occupants to support their health, safety, and comfort.

Requirement:

- ☐ For mechanically ventilated buildings, design ventilation systems that result in an air change effectiveness (E) greater than or equal to 0.9 as determined by ASHRAE 129-1997. For naturally ventilated spaces demonstrate a distribution and laminar flow pattern that involves not less than 90% of the room or zone area in the direction of air flow for at least 95% of hours of occupancy. **1**

Technologies /Strategies: Employ architectural and HVAC design strategies to increase ventilation effectiveness and prevent short-circuiting of airflow delivery. Techniques available include use of displacement ventilation, low velocity, and laminar flow ventilation (under floor or near floor delivery) and natural ventilation. Operable windows with an architectural strategy for natural ventilation, cross ventilation, or stack effect can be appropriate options with study of inlet areas and locations. See the LEED Reference Guide for compliance methodology guidelines.

5.C3 **Construction IAQ Management Plan** [2]

Intent: Prevent indoor air quality problems resulting from the construction/renovation process, to sustain long term installer and occupant health and comfort.

Requirement: Develop and implement an Indoor Air Quality (IAQ) Management Plan for the construction and pre-occupancy phases of the building as follows:

- ☐ During construction meet or exceed the minimum requirements of the Sheet Metal and Air Conditioning National Contractors Association (SMACNA) IAQ Guideline for Occupied Buildings under Construction, 1995, AND protect stored on-site or installed absorptive materials from moisture damage, AND replace all filtration media immediately prior to occupancy (Filtration media shall have a Minimum Efficiency Reporting Value (MERV) of 13 as determined by ASHRAE 52.2-1999). **1**
- ☐ Conduct a minimum two-week building flushout with new filtration media at 100% outside air after construction ends and prior to occupancy, OR, conduct a baseline indoor air quality testing procedure consistent with current EPA protocol for Environmental Requirements, Baseline IAQ and Materials, for the Research Triangle Park Campus, Section 01445. **1**

Technologies /Strategies: Specify containment control strategies including protecting the HVAC system, controlling pollutant sources, interrupting pathways for contamination, enforcing proper housekeeping and coordinating schedules to minimize disruption. Specify the construction sequencing to install absorptive materials after the prescribed dry or cure time of wet finishes to minimize adverse impacts on indoor air quality. Materials directly exposed to moisture through precipitation, plumbing leaks, or condensation from the HVAC system are susceptible to microbial contamination. Absorptive materials to protect and sequence installation include; insulation, carpeting, ceiling tiles, and gypsum products. Appoint an IEQ Manager with owner's authority to inspect IEQ problems and require mitigation as necessary.

5.C4 **Low-Emitting Materials** [2]

Intent: Reduce the quantity of indoor air contaminants that are odorous or potentially irritating to provide installer and occupant health and comfort.

Requirement: Meet or exceed VOC limits for adhesives, sealants, paints, composite wood products, and carpet systems as follows:

- ☐ Adhesives must meet or exceed the VOC limits of South Coast Air Quality Management District Rule #1168 by, AND all sealants used as a filler must meet or exceed Bay Area Air Resources Board Reg. 8, Rule 51. **1**
- ☐ Paints and coatings must meet or exceed the VOC and chemical component limits of Green Seal requirements. **1**
- ☐ Carpet systems must meet or exceed the Carpet and Rug Institute Green Label Indoor Air Quality Test Program. **1**
- ☐ Composite wood or agrifiber products must contain no added urea-formaldehyde resins. **1**

Technologies /Strategies: Evaluate and preferentially specify materials that are low emitting, non-irritating, nontoxic and chemically inert. Request and evaluate emissions test data from manufacturers for comparative products. Ensure that VOC limits are clearly stated in specifications, in General Conditions, or in each section where adhesives, sealants, coatings, carpets, and composite woods are addressed.

---

[2] © U. S. Green Building Council. Used by permission.

5.C5 **Indoor Chemical and Pollutant Source Control** [1]

Intent: Avoid exposure of building occupants to potentially hazardous chemicals that adversely impact air quality.

Requirement:

- ☐ Design to minimize cross-contamination of regularly occupied areas by chemical pollutants: **1**
  - Employ permanent entryway systems (grills, grates, etc.) to capture dirt, particulates, etc. from entering the building at all high volume entryways, AND provide areas with structural deck to deck partitions with separate outside exhausting, no air recirculation and negative pressure where chemical use occurs (including housekeeping areas and copying/print rooms), AND provide drains plumbed for appropriate disposal of liquid waste in spaces where water and chemical concentrate mixing occurs.

Technologies /Strategies: Design to physically isolate activities associated with chemical contaminants from other locations in the building, providing dedicated systems to contain and remove chemical pollutants from source emitters at source locations. Applicable measures include eliminating or isolating high hazard areas; designing all housekeeping chemical storage and mixing areas (central storage facilities and janitors closets) to allow for secure product storage; designing copy/fax/printer/printing rooms with structural deck to deck partitions and dedicated exhaust ventilation systems; and including permanent architectural entryway system(s) to catch and hold particles to keep them from entering and contaminating the building interior.

Consider utilization of EPA registered anti-microbial treatments in carpet, textile or vinyl wall coverings, ceiling tiles or paints where microbial contamination is a concern. Utilize "breathable" wall finishes where circumstances require, to reduce moisture build-up and prevent microbial contamination. Minimize selection of fibrous materials, e.g. insulation, carpet and padding and flexible fabrics, whose exposed surfaces when exposed to the air stream or occupied space can contribute significant emissions and absorb and re-emit other contaminants over time.

5.C6 **Controllability of Systems** [2]

Intent: Provide a high level of individual occupant control of thermal, ventilation, and lighting systems to support optimum health, productivity, and comfort conditions.

Requirement:

- ☐ Provide a minimum of one operable window and one lighting control zone per 200 s.f. for all occupied areas within 15 feet of the perimeter wall. **1**
- ☐ Provide controls for each individual for airflow, temperature, and lighting for 50% of the non perimeter, regularly occupied areas. **1**

Technologies /Strategies: Provide individual or integrated controls systems that control lighting, airflow, and temperature in individual rooms and/or work areas. Consider combinations of ambient and task lighting control and operable windows for perimeter and VAV systems for non perimeter with a 1:1: 2 terminal box to controller to occupant ratio.

5.C7 **Thermal Comfort** [2]

Intent: Provide for a thermally comfortable environment that supports the productive and healthy performance of the building occupants.

Requirement:

- ☐ Comply with ASHRAE Standard 55-1992, Addenda 1995 for thermal comfort standards including humidity control within established ranges per climate zone. **1**
- ☐ Install a permanent temperature and humidity monitoring system configured to provide operators control over thermal comfort performance and effectiveness of humidification and/or dehumidification systems in the building. **1**

Technologies /Strategies: Integrated envelope and HVAC system design strategies that achieve thermal comfort conditions based on mean radiant temperature, local air velocity, relative humidity, and air temperature. Install and maintain a temperature and humidity monitoring system for key areas of the building (i.e., at the perimeter, and spaces provided with humidity control). This function can be satisfied by the building automation system. Specify in system operation manuals that all sensors require quarterly calibration. Include criteria verification and system operation in commissioning plan and report.

---

[1] Adapted material not reviewed or endorsed by U. S. Green Building Council.

[2] © U. S. Green Building Council. Used by permission.

5.C8 **Daylight and Views** [2]

Intent: Provide a connection between indoor spaces and the outdoor environment through the introduction of sunlight and views into the occupied areas of the building.

Requirement:

- ☐ Achieve a minimum Daylight Factor of 2% (excluding all direct sunlight penetration) in 75% of all space occupied for critical visual tasks, not including copy rooms, storage areas, mechanical, laundry, and other low occupancy support areas. Exceptions include those spaces where tasks would be hindered by the use of daylight or where accomplishing the specific tasks within a space would be enhanced by the direct penetration of sunlight. **1**

- ☐ Direct line of sight to vision glazing from 90% of all regularly occupied spaces, not including copy rooms, storage areas, mechanical, laundry, and other low occupancy support areas. **1**

Technologies /Strategies: Implement design strategies to provide access to daylight and views to the outdoors in a glare-free way using exterior sun shading, interior light shelves, and /or window treatments. Orient buildings to maximize daylighting options. Consider shallow or narrow building footprints. Employ courtyards, atriums, clerestory windows, skylights, and light shelves to achieve daylight penetration (from other than direct effect or direct rays from the sun) deep into regularly occupied areas of the building.

5.C9 **Acoustic Environment /Noise Control**

Intent: Provide appropriate acoustic conditions for user privacy and comfort.

Requirement:

- ☐ Minimize environmental noise through appropriate use of insulation, sound-absorbing materials and noise source isolation. **1**

Technologies /Strategies: Evaluate each occupied environment and determine the appropriate layout, materials and furnishings design.

5.C10 **Facility In-Use IAQ Management Plan**

Intent: Insure the effective management of facility air quality during its life.

Requirement:

- ☐ Perform all of the following: **1**
  - Develop an air quality action plan to include scheduled HVAC system cleaning.
  - Develop an air quality action plan to include education of occupants and facility managers on indoor pollutants and their roles in preventing them.
  - Develop an air quality action plan to include permanent monitoring of supply and return air, and ambient air at the fresh air intake, for carbon monoxide (CO), carbon dioxide (CO 2), total volatile organic compounds (TVOCs), and particulates (including PM10).

Technologies /Strategies: Provide action plan for periodic system maintenance, monitoring, occupant/manager training.

---

[2] © U. S. Green Building Council. Used by permission.

6.0 Facility Delivery Process — Score 7

6.C1 **Holistic Delivery of Facility**

Intent: Encourage a facility delivery process that actively engages all stakeholders in the design process to deliver a facility that meets all functional requirements while effectively optimizing tradeoffs among sustainability, first costs, life cycle costs and mission requirements.

Requirement:

❑	Choose team leaders that are experienced in holistic delivery of facilities.	1
❑	Train the entire team in the holistic delivery process. The team must include all stakeholders in the facility delivery, including the users, the contracting staff, the construction representatives, project manager, and design/engineering team members.	1
❑	Identify project goals and metrics.	1
❑	Plan and execute charrettes with team members at critical phases of the facility delivery.	1
❑	Identify and resolve tradeoffs among sustainability, first costs, life cycle costs and mission requirements through charrettes and other collaborative processes.	2
❑	Document required results for each phase of project deliverables that achieve the project goals and are measurable throughout the facility life span.	1

Technologies /Strategies:

Develop performance specifications or choose competitive range of products that meet environmental criteria.

Use automated modeling and analysis tools to assess site and facility design alternatives.

Conduct life-cycle cost analysis (LCCA) in the design process according to the Federal Facilities Council Technical Report, Sustainable Federal Facilities: A Guide To Integrating Value Engineering, Life Cycle Costing, and Sustainable Development, FFC # 142, 2000.

Conduct a full ecological assessment to include soil quality, water resources and flows, vegetation and trees, wildlife habitats and corridors, wetlands, and ecologically sensitive areas to identify the least sensitive site areas for development. Evaluate space utilization/functions to reduce overall space requirements, considering networking, flextime, flexi-place, dual-use, and other strategies to reduce space requirements/optimize facility size.

7.0 Current Mission — Score 6

7.C1 **Operation and Maintenance**

Intent: Encourage the development of a facility delivery process that enhances efficient operation and maintenance of the facility.

Requirement:

- ☐ Develop a facility operations and maintenance program to include: **2**
  - Commissioning instructions for all facility systems.
  - Comprehensive facility operations and maintenance instructions for system operation, performance verification procedures and results, an equipment inventory, warrantee information, and recommended maintenance schedule. The instructions should include a comprehensive, preventive maintenance program to keep all facility systems functioning as designed.
  - A periodic training program for occupants, facilities managers, and maintenance staff in all facility operations and maintenance activities.
  - Instructions on sustainable cleaning and pest control practices.
  - Develop a comprehensive site/facility recycling/waste management plan.
- ☐ Provide surfaces, furnishings, and equipment that are appropriately durable, according to life cycle cost analysis. **1**

Technologies /Strategies: Maintain facility elements, systems and subsystems on a routine maintenance schedule to ensure integrity and longevity.

Perform scheduled cleaning and maintenance activities with nontoxic environmentally preferable cleaning products and procedures. Keep air ducts clean and free of microorganisms through a structured program of preventive maintenance. Clean lighting systems following a regular maintenance schedule to ensure optimum light output and energy efficiency.

Use pesticides and herbicides sparingly and only when necessary with preference to natural methods and materials over poisons and toxic agents.

Use automated monitors and controls for energy, water, waste, temperature, moisture, and ventilation monitors and controls. Turn off the lights, computers, computer monitors, and equipment when not in use. Enable power-down features on office equipment.

7.C2 **Soldier and Workforce Productivity and Retention**

Intent: Provide a high-quality, functional, healthy and safe work environment to promote soldier and workforce productivity and retention.

Requirement:

- ☐ Provide a high quality indoor environment to enhance user/occupant quality of life (QOL). **1**
- ☐ Provide a highly functional work environment to promote user/occupant work productivity. **1**
- ☐ Provide a healthy and safe work environment to sustain QOL and productivity. **1**

Technologies /Strategies: Use a registered/certified interior designer to provide stimulating interior environments with pleasant colors, surface treatments, room proportions and ceiling heights, external views, natural lighting, and quality detailing for interior furnishings, equipment, materials and finishes. Use IES standards to provide light to occupied space with variations in level, comfortable contrasts, natural color rendition, natural/man-made, and adequate controls to optimize light aesthetic qualities. Provide occupant control of individual work areas configuration, and lighting, thermal and ventilation systems.

Collaborate with end users to identify functional and technical requirements and to perform adjacency studies. Configure occupied space to address the specific workers/occupants functions and activities that will be carried out there. Meet TI 800-01 Design Guide requirements. Design and configure occupied space, and select furniture and equipment using human ergonomics. Identify existing user amenities, such as dining, recreation, socialization, shopping and child care facilities. Identify what amenities should be incorporated into the project or provided in the future, nearby facility. Provide ventilation air in sufficient volume free from natural and man made contaminants.

8.0 Future Missions — Score 4

8.C1 **Functional Life of Facility and Supporting Systems**

Intent: Assess the functional life of a facility and its supporting systems to optimize the infrastructure investment.

Requirement:

- ☐ Identify how long the designed function is likely to occupy the current facility. **1**
- ☐ Identify how long the envelope, structure, HVAC, plumbing, communications, electrical, and other systems are likely to last before requiring replacement or upgrade. Consider economic, functional and physical obsolescence. **1**

Technologies /Strategies: Assess the typical or likely lifespan of the function(s) to be accommodated to forecast eventual adaptation to a different use(s). Assess the life spans of the various building systems/components to forecast their revision/replacement during the facility lifespan and design in a manner that facilitates revision/replacement.

Consider the life span of the weapon systems, doctrines, or other programs supported by the facility.

Use life cycle data and other sources to identify the life span of the embodied systems.

8.C2 **Adaptation, Renewal and Future Uses**

Intent: Encourage facility design that is responsive to change over time to maximize accommodation of future uses without creating waste and insuring maximum useful life of products.

Requirement:

- ☐ Identify possible future uses for the facility; consider alternatives that expand the list of possible future uses. AND Design the building to accommodate as wide a range of future uses, as practical. AND Design the installation of building systems to accommodate foreseeable change with a minimum amount of disruption, cost, and additional materials. **1**
- ☐ Build the smallest facility necessary to meet current mission functional requirements, using the most efficient shape and form, while taking into consideration expansion capabilities and potential future mission requirements. AND Design the facility for recycling of materials and systems. **1**

Technologies /Strategies: Create durable, long-lasting and adaptable facility shell and structural system. Create an adaptable, flexible facility design using open planning, service corridors, interstitial space, access floors, demountable walls/partitions, modular furniture and other adaptable space configuration/utilization strategies.

Select materials that are recyclable, avoiding composite materials, such as reinforced plastics and carpet fibers and backing. Consider selecting materials and labeling construction materials with identification information to facilitate recycling. Use pre-cut/pre-fabricated materials and use standard lengths and sizes (dimensional modularity) in design. Design facility systems and subsystems for reconfiguration and/or disassembly/recycling using reversible/reusable connectors.

Facility Points Summary

1.0	Sustainable Sites (S)	Score	0	Max 20
1.R1	❑ Erosion, Sedimentation and Water Quality Control			[Required]
1.C1	❑ Site Selection			2
1.C2	❑ Installation/Base Redevelopment			2
1.C3	❑ Brownfield Redevelopment			1
1.C4	❑ Alternative Transportation			4
1.C5	❑ Reduced Site Disturbance			2
1.C6	❑ Stormwater Management			2
1.C7	❑ Landscape and Exterior Design to Reduce Heat Islands			2
1.C8	❑ Light Pollution Reduction			1
1.C9	❑ Optimize Site Features			1
1.C10	❑ Facility Impact			2
1.C11	❑ Site Ecology			1
			0	Max 5
2.C1	❑ Water Efficient Landscaping			2
2.C2	❑ Innovative Wastewater Technologies			1
2.C3	❑ Water Use Reduction			2
			0	Max 28
3.R1	❑ Fundamental Building Systems Commissioning			[Required]
3.R2	❑ Minimum Energy Performance			[Required]
3.R3	❑ CFC Reduction in HVAC&R Equipment			[Required]
3.C1	❑ Optimize Energy Performance			20
3.C2	❑ Renewable Energy			4
3.C3	❑ Additional Commissioning			1
3.C4	❑ <<Deleted>>			
3.C5	❑ Measurement and Verification			1
3.C6	❑ Green Power			1
3.C7	❑ Distributed Generation			1
4.0	Materials and Resources (M)	Score	0	Max 13
4.R1	❑ Storage & Collection of Recyclables			[Required]
4.C1	❑ Building Reuse			3
4.C2	❑ Construction Waste Management			2
4.C3	❑ Resource Reuse			2
4.C4	❑ Recycled Content			2
4.C5	❑ Local/Regional Materials			2
4.C6	❑ Rapidly Renewable Materials			1
4.C7	❑ Certified Wood			1
5.0	Indoor Environmental Quality (IEQ) [Q]	Score	0	Max 17
5.R1	❑ Minimum IAQ Performance			[Required]
5.R2	❑ Environmental Tobacco Smoke (ETS) Control			[Required]
5.C1	❑ IAQ Monitoring			1
5.C2	❑ Increase Ventilation Effectiveness			1
5.C3	❑ Construction IAQ Management Plan			2
5.C4	❑ Low-Emitting Materials			4
5.C5	❑ Indoor Chemical and Pollutant Source Control			1
5.C6	❑ Controllability of Systems			2
5.C7	❑ Thermal Comfort			2
5.C8	❑ Daylight and Views			2
5.C9	❑ Acoustic Environment /Noise Control			1
5.C10	❑ Facility In-Use IAQ Management Plan			1

Facility Points Summary (Continued)

				Maximum Points
6.0	Facility Delivery Process (P)	Score	0	Max 7
6.C1	☐ Holistic Delivery of Facility			7
7.0	Current Mission	Score	0	Max 6
7.C1	☐ Operation and Maintenance			3
7.C2	☐ Soldier and Workforce Productivity and Retention			3
8.0	Future Missions	Score	0	Max 4
8.C1	☐ Functional Life of Facility and Supporting Systems			2
8.C2	☐ Adaptation, Renewal and Future Uses			2

Total Score 0 Max 100

SPiRiT Sustainable Project Certification Levels

SPiRiT Bronze		**25 to 34 Points**
SPiRiT Silver		**35 to 49 Points**
SPiRiT Gold		**50 to 74 Points**
SPiRiT Platinum		**75 to 100 Points**

Project Points of Contact

SPiRiT Comment Sheet

Please forward any comments that you may have on this Sustainable Project Rating Tool, preferably by Email, to:

Mr. Harry Goradia
U. S. Army Corps of Engineers
ATTN: CEMP-ET
7701 Telegraph Road
Alexandria, VA 22315-3862
Phone 703-428-6460
FAX 703-428-7903
Email harry.goradia@hq02.usace.army.mil

SPiRiT Para.